**Four-Way Intersection Traffic Signal – Logic Works Simulation**

**A Digital Logic Design Lab Course Project**

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**Course:** Digital Logic Design Lab  
**Lab Instructor:** Sir Ishtiaq Ahmed  
**Tool Used:** Logic Works 5

**Project Overview**

This project presents the digital simulation of a four-way traffic intersection using Logic Works 5. Designed as part of our Digital Logic Design coursework, the objective was to replicate the behavior of real-world traffic signals at a crossroad using digital logic principles. Our circuit design includes timer-controlled transitions, and LED indicators showcasing the practical application of FSMs (Finite State Machines), counters, and combinational logic.

**Features**

* **Finite State Machine (FSM) based Light Control**: Governs the transitions between different traffic signal states.
* **Timer Simulation**: Binary counters simulate green and yellow durations.
* **LED Indicators**: Represent signal states (Green, Yellow, Red) for North, South, East, and West directions.
* **Clock-Driven State Transitions**: A consistent clock pulse advances system states.

**Logic Works Design Components**

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| **Component** | **Purpose** |
| Flip-Flops | Store FSM states |
| Counters | Implement green and yellow light timers |
| LEDs | Indicate signal status (Green/Yellow/Red) |
| Clocks | Provide timed state transitions |
| Logic Gates | Implement next-state and output logic |

**Circuit Operation**

1. **Initialization**: Upon reset, all directions are given a red signal briefly to ensure a stable start.
2. **Signal Cycle**:
   * The South direction is given a green signal, followed by yellow, then red.
   * East follows the same sequence afterward.
   * North follows the same sequence afterward.
   * West follows the same sequence afterward.
3. **Timers**: The length of each green and yellow phase is determined by binary counters synced with a clock pulse.
4. **Continuous Looping**: The FSM ensures that the cycle repeats indefinitely, simulating continuous real-world traffic control.

**Conclusion**

This project effectively demonstrates the application of core digital design principles to a real-world problem. Through Logic Works, we successfully created a functioning model of a four-way traffic light controller that incorporates timing, and state control. The simulation provides insight into how logic circuits manage time-sensitive, sequential decision-making in infrastructure systems.